OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **STEVENS POND** the program coordinators recommend the following actions.

We are pleased to welcome the Manchester Urban Ponds Restoration Project to the New Hampshire Volunteer Lake Assessment Program. Manchester's volunteers collected a lot of samples this summer and we applaud them for their efforts. Although it takes a few years to establish lake quality trends, we hope that this project will encourage the citizens of the city to continue their active participation in sampling and help to reverse the degraded conditions of the ponds. We encourage the Project Coordinator to establish a wet weather sampling program in the future. Samples collected during rain events allow us to determine non-point sources of pollution to the lake. Since the project's goals include restoring the quality of the urban ponds and reducing pollutant loads data collected from wet weather sampling will allow biologists to better evaluate phosphorus loading to the lake.

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a, also a measure of algal abundance, in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The current year data (the top graph) show a *stable* in-lake chlorophyll-a trend throughout the summer, with levels below the state average. There was a sharp increase in September. When chlorophyll-a levels exceed 16 mg/m^3 algal concentrations reach nuisance levels. This is often indicated through obvious greenish or bluish scum on the water. The plankton sample taken in September was not preserved and no whole cells were found, so there were no scans done of the sample. Therefore, we cannot tell what caused the large increase in chlorophyll-a for that month. We will watch for this trend to reoccur next year. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The upper graph shows a *stable, but declining,* trend in lake transparency over the course of the summer. The lowest clarity was recorded in September, which correlates with the chlorophyll-a level. The average reading was below the state mean. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show hypolimnetic phosphorus levels were *very high,* as were epilimnetic levels late in the summer. The early summer epilimnetic concentrations were below the state median. The September algal bloom could have been the result of elevated phosphorus concentrations in the water column. Turbidity was also high on each sampling date for each of the in-lake samples. Please be sure no sediment is getting into the sample bottle. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Fish were collected from Stevens Pond due to the cooperative efforts of NH Fish & Game, US Fish and Wildlife Service, NHDES, and the Manchester Urban Pond Restoration Coordinator (MUPRC). Five Yellow Perch were analyzed by the NH Department of Health and Human Services for Mercury (Hg) and all came back significantly less than the Human Health limit of 1 part per billion (ppb). Five Large Mouth Bass were also collected and were sent to the University of Connecticut for further human health or eco-risk analyses, but the results are not yet available.

  NHDES and MUPRC plan on collecting stormwater samples at Stevens Pond this winter. Samples will be collected from Interstate 93's stormwater discharge during a winter rain event or snow melt. The purpose of the sampling effort is to quantify the water quality characteristics of I-93's stormwater runoff and determine the level of impact it is having on the water quality of Stevens Pond.

- Conductivity in Stevens Pond was very high throughout the summer (Table 6). Conductivity increases often indicate the influence of human activities on surface waters. Septic system leachate, agricultural runoff, iron deposits, and road runoff (see above) can all influence conductivity. It would be useful to uncover the reasons for increased conductivity as we continue to monitor the lake.

- Dissolved oxygen was quite low in the hypolimnion this summer (Table 9). The process of decomposition in the sediments depletes dissolved oxygen on the bottom of thermally stratified lakes. As bacteria break down organic matter, they deplete oxygen in the water. When oxygen gets below 1 mg/L, phosphorus normally bound up in the mud may be released into the water column, a process that is referred to as *internal loading*. Depleted oxygen in the hypolimnion usually occurs as the summer progresses. This explains the higher phosphorus in the hypolimnion (lower water layer) versus the epilimnion (upper layer). Since an internal source of phosphorus to the lake is present, limiting or eliminating external phosphorus sources in the lake's watershed is even more important for lake protection.

NOTES

- Monitor's Note (6/29/00): Greenish, murky water. Fish kill on 6/10, approximately 100 panfish.

- Monitor's Note (8/23/00): Extensive vegetation (pond lilies) near boat launch. Mallards present.

USEFUL RESOURCES

What Can You Do to Prevent Shoreland Erosion?, WD-BB-30, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

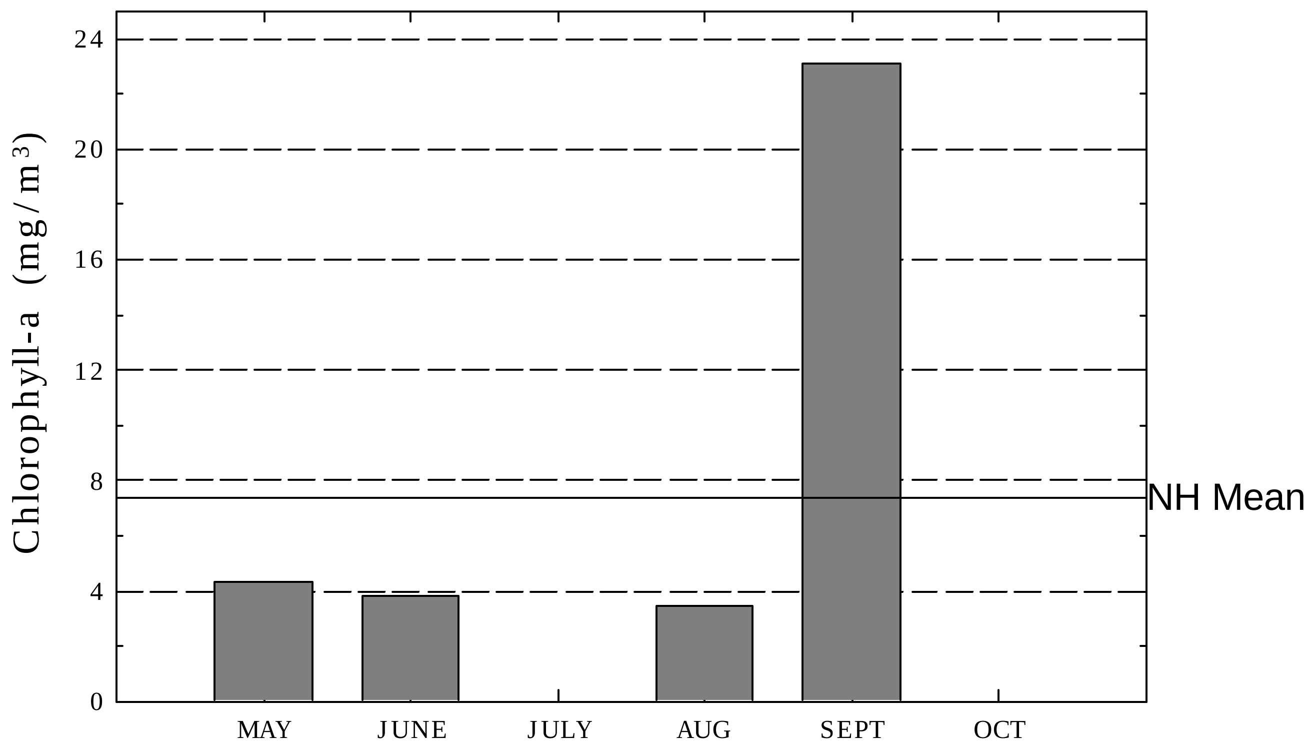
Nonpoint Source Pollution and Stormwater Fact Sheet Package. Terrene Institute. (703) 661-1582.

Effects of Phosphorus on New Hampshire's Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

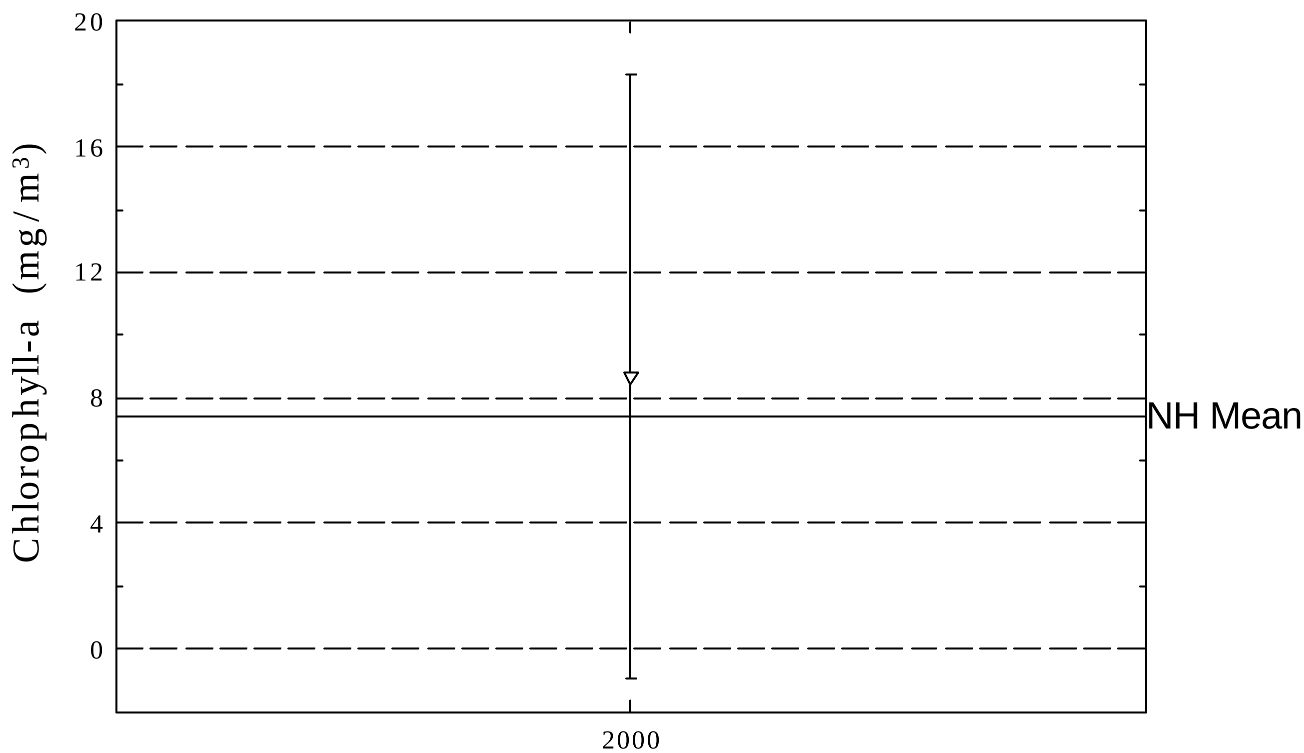
Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, *NHDES-WD 97-8*, NHDES Booklet, (603) 271-3503

Stevens Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



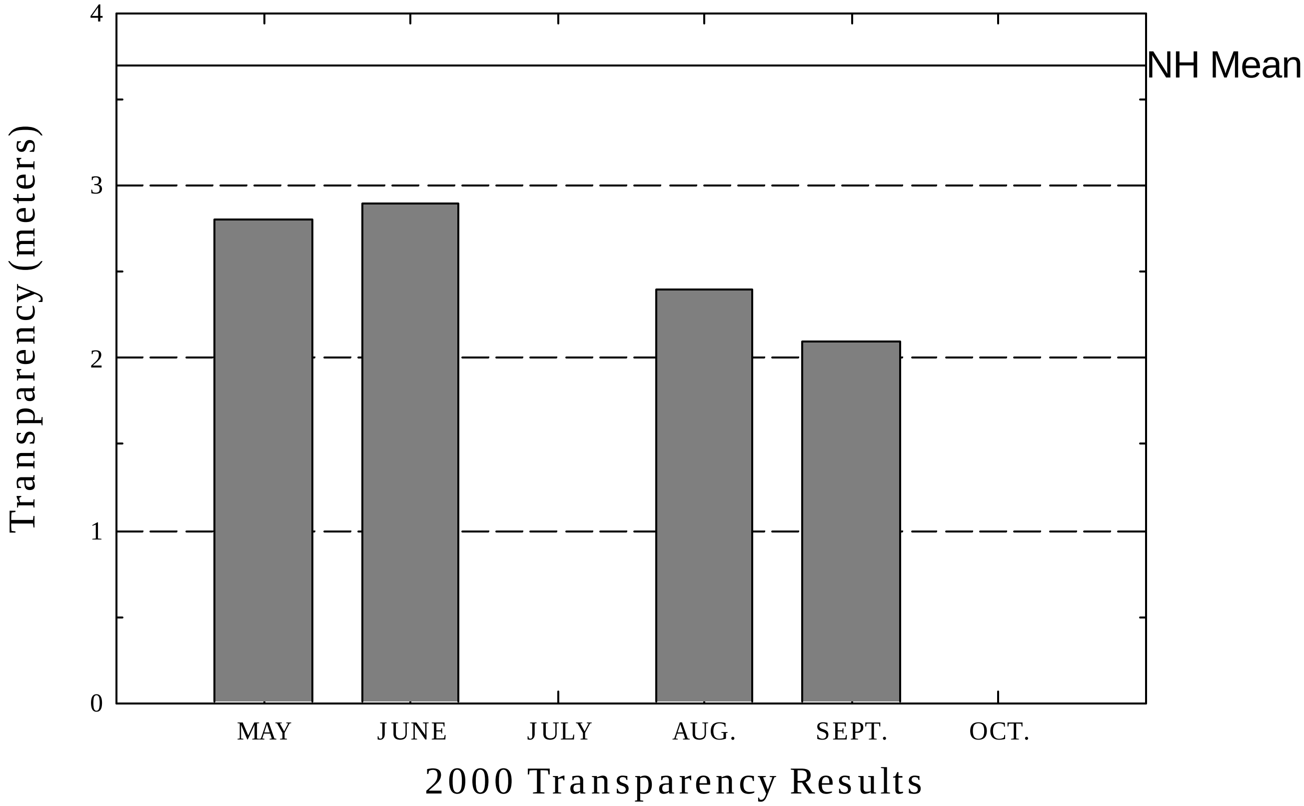
2000 Chlorophyll-a Results

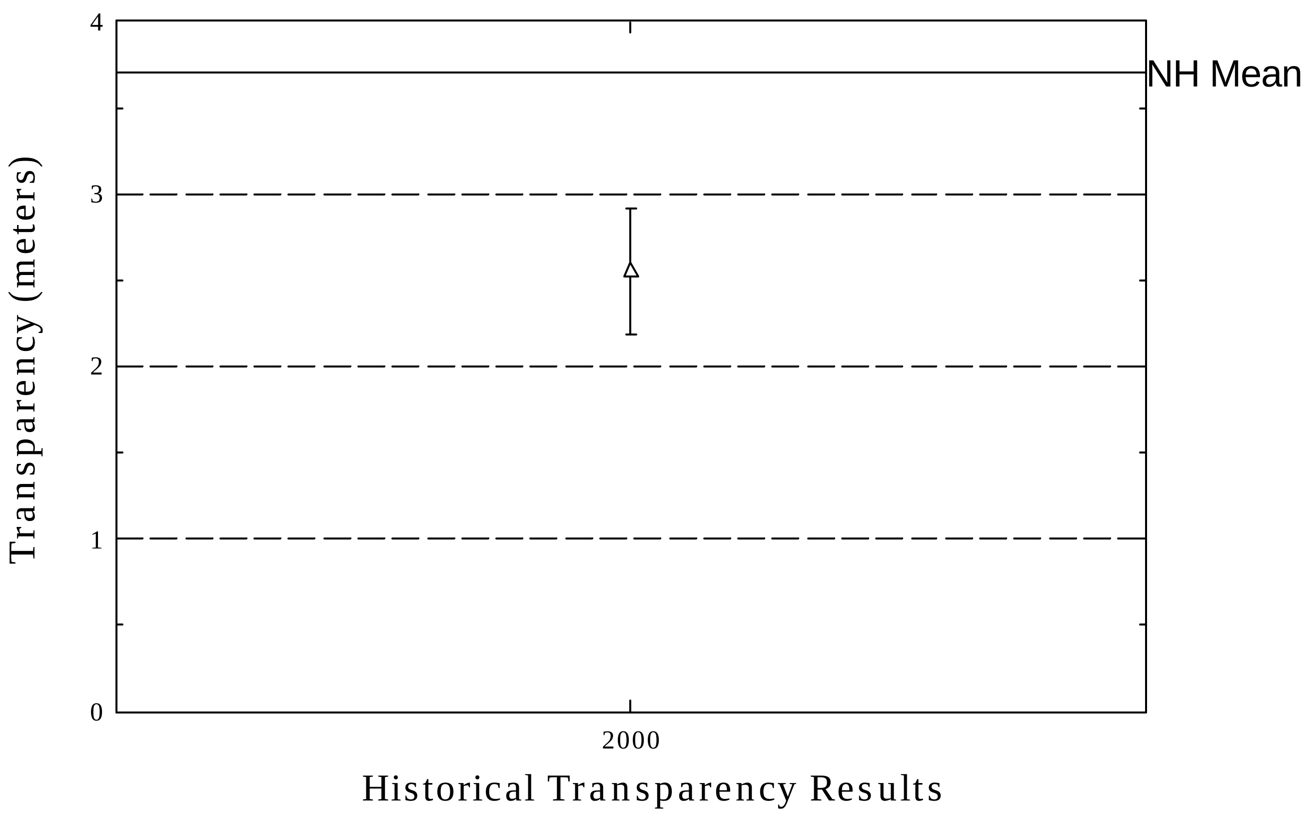


Historical Chlorophyll-a Results

Stevens Pond

Figure 2. Monthly and Historical Transparency Results





Stevens Pond

Figure 3. Monthly and Historical Total Phosphorus Data.

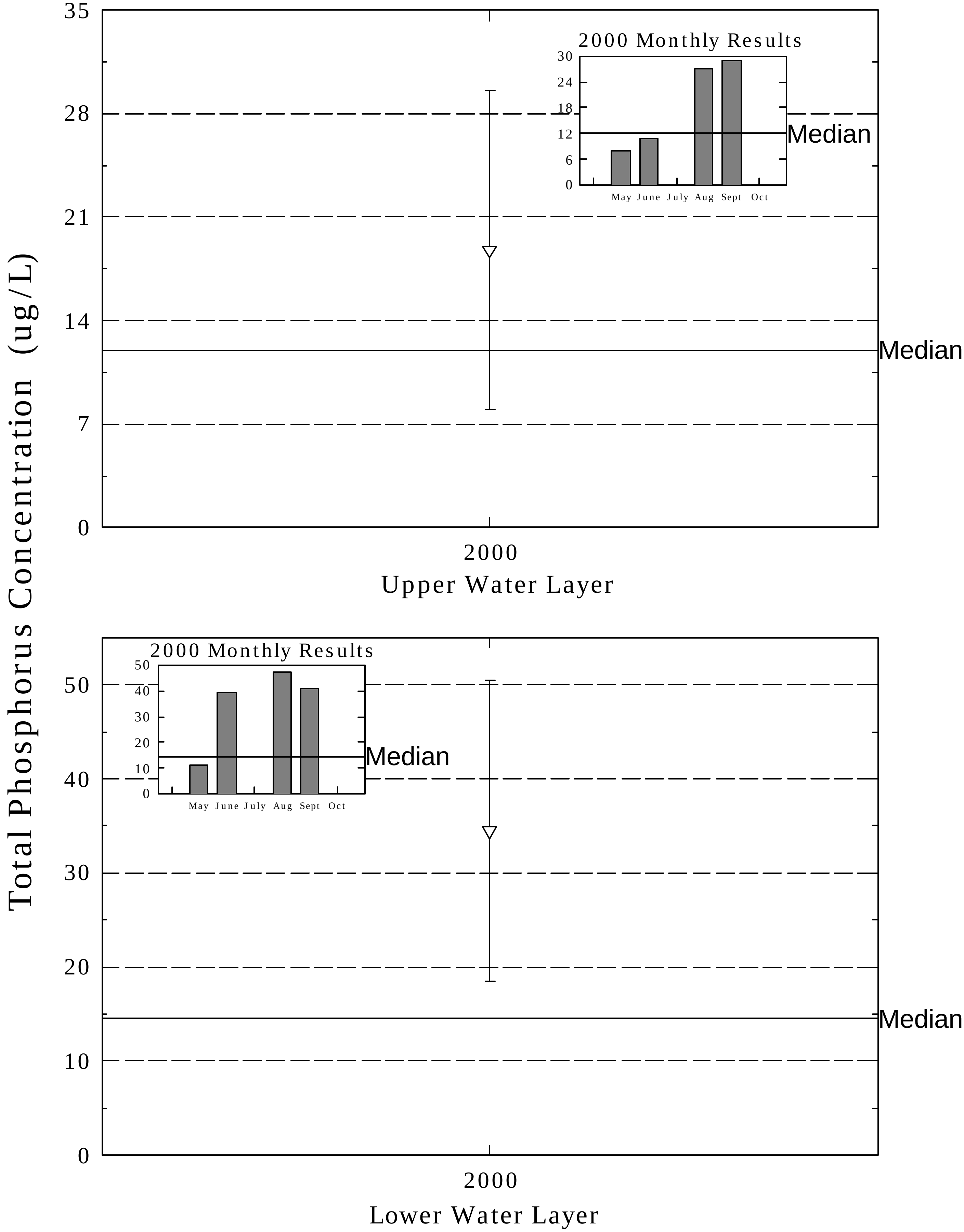


Table 1.

STEVENS POND

MANCHESTER

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
2000	3.44	23.11	11.56

Table 2.

STEVENS POND

MANCHESTER

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
05/23/2000	MALLOMONAS	50
	CYCLOTELLA	17
	FRAGILARIA	12
06/29/2000	CERATIUM	55
	DINOBRYON	42
	TABELLARIA	2
08/23/2000	CERATIUM	87
	DINOBRYON	6
	SYNURA	2

Table 3.

STEVENS POND

MANCHESTER

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
2000	2.1	2.9	2.4

Table 4.

STEVENS POND
MANCHESTER

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	2000	7.08	7.34	7.23
HYPOLIMNION				
	2000	6.48	7.21	6.85
METALIMNION				
	2000	7.05	7.25	7.13

Table 5.

STEVENS POND

MANCHESTER

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
2000	28.70	38.70	34.23

Table 6.

STEVENS POND
MANCHESTER

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	2000	742.0	803.0	769.0
HYPOLIMNION				
	2000	759.0	872.0	801.7
METALIMNION				
	2000	743.0	778.0	761.5

Table 8.

STEVENS POND

MANCHESTER

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	2000	8	29	18
HYPOLIMNION				
	2000	11	47	34
METALIMNION				
	2000	12	94	36

Table 9.

STEVENS POND
MANCHESTER

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
May 23, 2000			
0.1	13.7	9.1	87.0
1.0	13.7	8.8	84.0
2.0	13.6	8.8	84.0
3.0	12.4	9.5	89.0
4.0	10.3	8.1	72.0
4.5	9.9	5.5	49.0
June 29, 2000			
0.1	24.5	5.5	66.0
1.0	24.4	5.4	65.0
2.0	20.1	8.4	93.0
3.0	15.9	8.2	83.0
4.0	12.5	1.9	18.0
5.0	11.4	0.1	1.0
August 23, 2000			
0.1	20.9	6.2	69.0
1.0	20.7	6.1	68.0
2.0	20.2	5.1	56.0
3.0	19.3	1.5	17.0
4.0	15.2	0.1	1.0
4.5	13.5	0.1	1.0
September 27, 2000			
0.1	18.1	6.3	67.0
1.0	17.1	5.9	61.0
2.0	16.2	5.7	58.0
3.0	15.8	4.7	48.0
4.0	15.6	4.6	47.0
5.0	13.7	0.2	2.0

Table 10.

STEVENS POND

MANCHESTER

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
May 23, 2000	4.5	9.9	5.5	49.0
June 29, 2000	5.0	11.4	0.1	1.0
August 23, 2000	4.5	13.5	0.1	1.0
September 27, 2000	5.0	13.7	0.2	2.0

Table 11.

STEVENS POND

MANCHESTER

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	2000	1.0	3.2	2.3
HYPOLIMNION				
	2000	0.7	34.0	9.9
METALIMNION				
	2000	0.9	4.1	2.2